

# PATENT COOPERATION TREATY

PCT

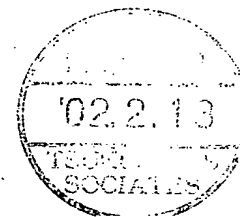
NOTICE INFORMING THE APPLICANT OF THE  
COMMUNICATION OF THE INTERNATIONAL  
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

TSUKUNI, Hajime  
SVAX TS Building  
22-12, Toranomom 1-chome  
Minato-ku  
Tokyo 105-0001  
JAPON



|   |   |   |
|---|---|---|
| Date of mailing (day/month/year)<br>07 February 2002 (07.02.02) |   |   |
| Applicant's or agent's file reference<br>FP2433PCT              |   | <b>IMPORTANT NOTICE</b>                                   |
| International application No.<br>PCT/JP01/06421                 | International filing date (day/month/year)<br>26 July 2001 (26.07.01) |   |
|   |   | Priority date (day/month/year)<br>28 July 2000 (28.07.00) |
| Applicant<br>AOYAMA SEISAKUSHO CO., LTD. et al                  |   |   |

1. Notice is hereby given that the International Bureau has **communicated**, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this notice:

US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

CN,EP,JP

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this notice is a copy of the international application as published by the International Bureau on 07 February 2002 (07.02.02) under No. WO 02/10595

## REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

## REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and the PCT Applicant's Guide, Volume II.

|  |   |
|--|---|
| The International Bureau of WIPO<br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland<br><br>Facsimile No. (41-22) 740.14.35 | Authorized officer<br><br>J. Zahra<br><br>Telephone No. (41-22) 338.91.11 |
|--|---|

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## PATENT COOPERATION TREATY

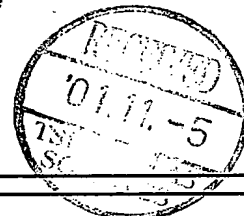
PCT

NOTIFICATION CONCERNING  
SUBMISSION OR TRANSMITTAL  
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

TSUKUNI, Hajime  
SVAX TS Building  
22-12, Toranomom 1-chome  
Minato-ku  
Tokyo 105-0001  
JAPON

|  |   |  |  |
|--|---|--|--|
| Date of mailing (day/month/year)<br>14 September 2001 (14.09.01)     |   |  |  |
| Applicant's or agent's file reference<br>FP2433PCT                   | IMPORTANT NOTIFICATION  |  |  |
| International application No.<br>PCT/JP01/06421                      | International filing date (day/month/year)<br>26 July 2001 (26.07.01) |  |  |
| International publication date (day/month/year)<br>Not yet published | Priority date (day/month/year)<br>28 July 2000 (28.07.00)             |  |  |
| Applicant<br>AOYAMA SEISAKUSHO CO., LTD. et al                       |   |  |  |

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(\*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

| <u>Priority date</u>    | <u>Priority application No.</u> | <u>Country or regional Office<br/>or PCT receiving Office</u> | <u>Date of receipt<br/>of priority document</u> |
|-------------------------|---------------------------------|---|---|
| 28 July 2000 (28.07.00) | PCT/JP00/05035                  | JP  | 10 Augu 2001 (10.08.01)                         |

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

Y. KUWAHARA

Telephone No. (41-22) 338.83.38

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The physical requirements of the international application are not complied with to the extent which is necessary for the purpose of a reasonably uniform international publication, as specified below (Rule 11). The receiving Office has found the following defects in the presentation of the drawings of the international application:

I. In regard to the sheets containing drawings:

- a. ☐ the sheets do not admit of direct reproduction.
- b. ☐ the sheets are not free from creases, cracks, folds.
- c. ☐ one side of the sheets is not left unused.
- d. ☐ the paper of the sheets is not flexible/strong/white/smooth/non-shiny/durable.
- e. ☐ the drawings do not commence on a new sheet.
- f. ☐ the sheets are not connected as prescribed (Rule 11.4(b)).
- g. ☐ the sheets are not A4 size (29.7cm x 21cm).
- h. ☐ the minimum margins on the sheets are not as prescribed (top: 2.5cm; left side: 2.5cm; right side: 1.5cm; bottom: 1cm).
- i. ☐ the file reference number indicated on the sheets does not appear in the left-hand corner of the sheets, within 1.5 cm of the top of the sheets.
- j. ☐ the file reference number exceeds the maximum of 12 characters.
- k. ☐ the sheets are not free from frames around usable or used surfaces.
- l. ☐ the sheets are not numbered in consecutive Arabic numerals (e.g. 1/3, 2/3, 3/3).
- m. ☐ the sheet numbers are not centered at the top or bottom of the sheets.
- n. ☐ the sheet numbers are in the margin (see h. above for the size of the margins).
- o. ☐ the sheets contain alterations/overwritings/interlineations/too many erasures.
- p. ☐ the sheets contain photocopy marks.

II. The drawings (Rule 11.13):

- a. ☐ do not admit of direct reproduction.
- b. ☒ contain unnecessary text matter. <Fig. 5.6>
- c. ☐ contain words so placed as to prevent translation without interference with lines thereof.
- d. ☐ are not executed in durable black color; the lines are not uniformly thick and well-defined.
- e. ☐ contain cross-sections not properly hatched.
- f. ☐ would not be properly distinguishable in reduced reproduction.
- g. ☐ contain scales not represented graphically.
- h. ☐ contain numbers, letters and reference lines lacking simplicity and clarity.
- i. ☐ contain lines drafted without the aid of drafting instruments.
- j. ☐ contain disproportionate elements of a figure not necessary for clarity.
- k. ☐ contain numbers and letters of height less than 0.32 cm.
- l. ☐ contain letters not conforming to the Latin, and where customary, Greek alphabets.
- m. ☐ contain figures on two or more sheets which form a single complete figure but which are not able to be assembled without concealing parts thereof.
- n. ☐ contain figures which are not properly arranged and clearly separated.
- o. ☐ contain different figures not numbered in consecutive Arabic numerals.
- p. ☐ contain different figures not numbered independent of the numbering of the sheets.
- q. ☐ are not restricted to reference signs mentioned in the description.
- r. ☐ do not contain reference signs that are mentioned in the description.
- s. ☐ contain the same feature denoted by different reference signs.

Further observations (if necessary):

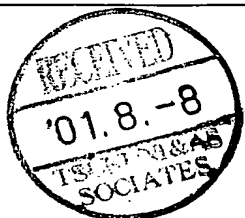
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# PCT COOPERATION TREATY

FROM THE RECEIVING OFFICE

TO:

TSUKUNI HAJIME



SVAX TS BLDG., 22-12, TORANOMONN 1-CHOME, M  
INATO-KU, TOKYO 105-0001 JAPAN

## P C T

INVITATION TO CORRECT DEFECTS IN  
THE INTERNATIONAL APPLICATION

(PCT ARTICLES 3(4)(I) AND 14(1) AND RULE 26)

PCT/JP01/06421

RO106

|                                       |   |
|---------------------------------------|---|
| DATE OF MAILING(DAY/MONTH/YEAR)       |   |
| 07. 08. 01                            |   |
| APPLICANT'S OR AGENT'S FILE REFERENCE | REPLY DUE   |
| FP2433PCT                             | WITHIN 1 MONTHS FROM<br>THE ABOVE DATE OF MAILING |
| INTERNATIONAL APPLICATION NO.         | INTERNATIONAL FILING DATE(DAY/MONTH/YEAR)         |
| PCT/JP01/06421                        | 26. 07. 01  |

APPLICANT

AOYAMA SEISAKUSHO CO., LTD.

THE APPLICANT IS HEREBY INVITED, WITHIN THE TIME LIMIT INDICATED ABOVE, TO CORRECT, IN THE INTERNATIONAL APPLICATION AS FILED, THE DEFECTS SPECIFIED ON THE ATTACHED

☐ Annex A

☐ Annex B

☒ Annex C

ADDITIONAL OBSERVATIONS(IF NECESSARY):

### HOW TO CORRECT THE DEFECTS?

CORRECTION MUST BE SUBMITTED BY FILING A REPLACEMENT SHEET EMBODYING THE CORRECTION AND A LETTER ACCOMPANYING THE REPLACEMENT SHEET, WHICH SHALL DRAW ATTENTION TO THE DIFFERENCE BETWEEN THE REPLACED SHEET AND THE REPLACEMENT SHEET. A CORRECTION MAY BE STATED IN A LETTER ONLY IF IT IS OF SUCH A NATURE THAT IT CAN BE TRANSFERRED FROM THE LETTER TO THE RECORD COPY WITHOUT ADVERSELY AFFECTING THE CLARITY AND DIRECT REPRODUCIBILITY OF THE SHEET ONTO WHICH CORRECTION IS TO BE TRANSFERRED(RULE 26.4(A)).

### ATTENTION

FAILURE TO CORRECT THE DEFECTS WILL RESULT IN THE INTERNATIONAL APPLICATION BEING CONSIDERED WITHDRAWN BY THIS RECEIVING OFFICE(SEE RULE 26.5 FOR FURTHER DETAILS).

A COPY OF THIS INVITATION AND ANY ATTACHMENTS HAS BEEN SENT TO INTERNATIONAL BUREAU

☐ AND THE INTERNATIONAL SEARCHING AUTHORITY

NAME AND MAILING ADDRESS OF THE RECEIVING OFFICE

JAPAN PATENT OFFICE

4-3, KASUMIGASEKI 3 CHOME,

CHIYODA-KU, TOKYO 100-8915 JAPAN

FACSIMILE NO.

AUTHORIZED OFFICER

Commissioner

Japan Patent Office

TELEPHONE NO. 03-3592-1308

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| <b>Box No. VI PRIORITY CLAIM</b>                       |                                      |                                  |   |  | <input type="checkbox"/> Further priority claims are indicated in the Supplemental Box. |
|--|--------------------------------------|----------------------------------|---|--|---|
| Filing date of earlier application<br>(day/month/year) | Number of earlier application        | Where earlier application is:    |   |  |   |
|  |                                      | national application:<br>country | regional application:*<br>regional Office | international application:<br>receiving Office |   |
| item (1)<br>28. 07. 00                                 | Patent Application<br>PCT/JP00/05035 | JAPAN                            |   |  |   |
| item (2)   |                                      |                                  |   |  |   |
| item (3)   |                                      |                                  |   |  |   |

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

|   |   |  |
|---|---|--|
| <b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>  |   |  |
| Choice of International Searching Authority (ISA)<br>(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):<br><br>ISA/ EP | Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):<br><br>Date (day/month/year)                      Number                      Country (or regional Office) |  |

|   |  |
|---|--|
| <b>Box No. VIII CHECK LIST; LANGUAGE OF FILING</b>  |  |
| This international application contains the following number of sheets:<br>request : 4<br>description (excluding sequence listing part) : 13<br>claims : 6<br>abstract : 1<br>drawings : 4<br>sequence listing part of description : 0<br>Total number of sheets : 28 | This international application is accompanied by the item(s) marked below:<br>1. <input checked="" type="checkbox"/> fee calculation sheet<br>2. <input checked="" type="checkbox"/> separate signed power of attorney<br>3. <input type="checkbox"/> copy of general power of attorney; reference number, if any:<br>4. <input type="checkbox"/> statement explaining lack of signature<br>5. <input checked="" type="checkbox"/> priority document(s) identified in Box No. VI as item(s): ( 1 )<br>6. <input type="checkbox"/> translation of international application into (language):<br>7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material<br>8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form<br>9. <input type="checkbox"/> other (specify): |
| Figure of the drawings which should accompany the abstract:   | Language of filing of the international application: English   |

|  |  |
|--|--|
| <b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>  |  |
| Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request). |  |
| <br>TSUKUNI Hajime  |  |

|  |  |
|--|--|
| For receiving Office use only  |  |
| 1. Date of actual receipt of the purported international application:<br>3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:<br>4. Date of timely receipt of the required corrections under PCT Article 11(2):<br>5. International Searching Authority (if two or more are competent): ISA / | 2. Drawings:<br><input type="checkbox"/> received:<br><input type="checkbox"/> not received:<br>6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid. |

|   |                                   |
|---|-----------------------------------|
| Date of receipt of the record copy by the International Bureau: | For International Bureau use only |
|---|-----------------------------------|

Form PCT/RO/101 (last sheet) (July 1998; reprint January 2001) See Notes to the request form

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## Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

## Regional Patent

- ☐ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☐ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, TR Turkey, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |   |  |
|---|--|
| <input type="checkbox"/> AE United Arab Emirates                  | <input type="checkbox"/> LC Saint Lucia  |
| <input type="checkbox"/> AG Antigua and Barbuda                   | <input type="checkbox"/> LK Sri Lanka  |
| <input type="checkbox"/> AL Albania                               | <input type="checkbox"/> LR Liberia  |
| <input type="checkbox"/> AM Armenia                               | <input type="checkbox"/> LS Lesotho  |
| <input type="checkbox"/> AT Austria                               | <input type="checkbox"/> LT Lithuania  |
| <input type="checkbox"/> AU Australia                             | <input type="checkbox"/> LU Luxembourg   |
| <input type="checkbox"/> AZ Azerbaijan                            | <input type="checkbox"/> LV Latvia   |
| <input type="checkbox"/> BA Bosnia and Herzegovina                | <input type="checkbox"/> MA Morocco  |
| <input type="checkbox"/> BB Barbados                              | <input type="checkbox"/> MD Republic of Moldova  |
| <input type="checkbox"/> BG Bulgaria                              | <input type="checkbox"/> MG Madagascar   |
| <input type="checkbox"/> BR Brazil                                | <input type="checkbox"/> MK The former Yugoslav Republic of Macedonia                                      |
| <input type="checkbox"/> BY Belarus                               | <input type="checkbox"/> MN Mongolia   |
| <input type="checkbox"/> BZ Belize                                | <input type="checkbox"/> MW Malawi   |
| <input type="checkbox"/> CA Canada                                | <input type="checkbox"/> MX Mexico   |
| <input type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input type="checkbox"/> MZ Mozambique   |
| <input checked="" type="checkbox"/> CN China                      | <input type="checkbox"/> NO Norway   |
| <input type="checkbox"/> CR Costa Rica                            | <input type="checkbox"/> NZ New Zealand  |
| <input type="checkbox"/> CU Cuba                                  | <input type="checkbox"/> PL Poland   |
| <input type="checkbox"/> CZ Czech Republic                        | <input type="checkbox"/> PT Portugal   |
| <input type="checkbox"/> DE Germany                               | <input type="checkbox"/> RO Romania  |
| <input type="checkbox"/> DK Denmark                               | <input type="checkbox"/> RU Russian Federation   |
| <input type="checkbox"/> DM Dominica                              | <input type="checkbox"/> SD Sudan  |
| <input type="checkbox"/> DZ Algeria                               | <input type="checkbox"/> SE Sweden   |
| <input type="checkbox"/> EE Estonia                               | <input type="checkbox"/> SG Singapore  |
| <input type="checkbox"/> ES Spain                                 | <input type="checkbox"/> SI Slovenia   |
| <input type="checkbox"/> FI Finland                               | <input type="checkbox"/> SK Slovakia   |
| <input type="checkbox"/> GB United Kingdom                        | <input type="checkbox"/> SL Sierra Leone   |
| <input type="checkbox"/> GD Grenada                               | <input type="checkbox"/> TJ Tajikistan   |
| <input type="checkbox"/> GE Georgia                               | <input type="checkbox"/> TM Turkmenistan   |
| <input type="checkbox"/> GH Ghana                                 | <input type="checkbox"/> TR Turkey   |
| <input type="checkbox"/> GM Gambia                                | <input type="checkbox"/> TT Trinidad and Tobago  |
| <input type="checkbox"/> HR Croatia                               | <input type="checkbox"/> TZ United Republic of Tanzania  |
| <input type="checkbox"/> HU Hungary                               | <input type="checkbox"/> UA Ukraine  |
| <input type="checkbox"/> ID Indonesia                             | <input type="checkbox"/> UG Uganda   |
| <input type="checkbox"/> IL Israel                                | <input checked="" type="checkbox"/> US United States of America  |
| <input type="checkbox"/> IN India                                 | <input type="checkbox"/> UZ Uzbekistan   |
| <input type="checkbox"/> IS Iceland                               | <input type="checkbox"/> VN Viet Nam   |
| <input checked="" type="checkbox"/> JP Japan                      | <input type="checkbox"/> YU Yugoslavia   |
| <input type="checkbox"/> KE Kenya                                 | <input type="checkbox"/> ZA South Africa   |
| <input type="checkbox"/> KG Kyrgyzstan                            | <input type="checkbox"/> ZW Zimbabwe   |
| <input type="checkbox"/> KP Democratic People's Republic of Korea | Check-box reserved for designating States which have become party to the PCT after issuance of this sheet: |
| <input type="checkbox"/> KR Republic of Korea                     | <input type="checkbox"/>   |
| <input type="checkbox"/> KZ Kazakhstan                            |  |

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

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Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

*If none of the following sub-boxes is used, this sheet should not be included in the request.*

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

OZAWA Junzo

c/o Ohguchi Plant, AOYAMA SEISAKUSHO CO., LTD.,  
8, Takahashi 1-chome, Ohguchi-cho, Niwa-gun, Aichi  
480-0198 JAPAN

This person is:

- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

JAPAN

State (that is, country) of residence:

JAPAN

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

ITO Shuji

c/o Ohguchi Plant, AOYAMA SEISAKUSHO CO., LTD.,  
8, Takahashi 1-chome, Ohguchi-cho, Niwa-gun, Aichi  
480-0198 JAPAN

This person is:

- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

JAPAN

State (that is, country) of residence:

JAPAN

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

GOTOU Mitsushige

c/o KABUSHIKI KAISHA HONDA GIJUTSU KENKYUSHO,  
4-1, Chuo 1-chome, Wako-shi, Saitama 351-0193 JAPAN

This person is:

- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

JAPAN

State (that is, country) of residence:

JAPAN

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

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# PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference **FP2433PCT**  
(if desired) (12 characters maximum)



**Box No. I TITLE OF INVENTION**  
**FASTENER**

**Box No. II APPLICANT**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

**AOYAMA SEISAKUSHO CO., LTD.**

**101-2, Yagotohonmachi, Showa-ku, Nagoya-shi, Aichi**  
**466-0825 JAPAN**

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

**JAPAN**

State (that is, country) of residence:

**JAPAN**

This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

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This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

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☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

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**INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE**

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated in the Notification of Receipt of Record Copy (Form PCT/IB/301) by paying national fees and furnishing translations, as prescribed by the applicable national laws.

The time limit for performing these procedural acts is **20 MONTHS** from the priority date or, for those designated States which the applicant elects in a demand for international preliminary examination or in a later election, **30 MONTHS** from the priority date, provided that the election is made before the expiration of 19 months from the priority date. Some designated (or elected) Offices have fixed time limits which expire even later than 20 or 30 months from the priority date. In other Offices an extension of time or grace period, in some cases upon payment of an additional fee, is available.

In addition to these procedural acts, the applicant may also have to comply with other special requirements applicable in certain Offices. **It is the applicant's responsibility** to ensure that the necessary steps to enter the national phase are taken in a timely fashion. Most designated Offices do not issue reminders to applicants in connection with the entry into the national phase.

For detailed information about the procedural acts to be performed to enter the national phase before each designated Office, the applicable time limits and possible extensions of time or grace periods, and any other requirements, see the relevant Chapters of Volume II of the PCT Applicant's Guide. Information about the requirements for filing a demand for international preliminary examination is set out in Chapter IX of Volume I of the PCT Applicant's Guide.

GR and ES became bound by PCT Chapter II on 7 September 1996 and 6 September 1997, respectively, and may, therefore, be elected in a demand or a later election filed on or after 7 September 1996 and 6 September 1997, respectively, regardless of the filing date of the international application. (See second paragraph above.)

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

**CONFIRMATION OF PRECAUTIONARY DESIGNATIONS**

This notification lists only specific designations made under Rule 4.9(a) in the request. It is important to check that these designations are correct. Errors in designations can be corrected where precautionary designations have been made under Rule 4.9(b). The applicant is hereby reminded that any precautionary designations may be confirmed according to Rule 4.9(c) before the expiration of 15 months from the priority date. If it is not confirmed, it will automatically be regarded as withdrawn by the applicant. There will be no reminder and no invitation. Confirmation of a designation consists of the filing of a notice specifying the designated State concerned (with an indication of the kind of protection or treatment desired) and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.

**REQUIREMENTS REGARDING PRIORITY DOCUMENTS**

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 16 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 16-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 16-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity to furnish the priority document within a time limit which is reasonable under the circumstances.

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 16-month time limit is the filing date of the earliest application whose priority is claimed.

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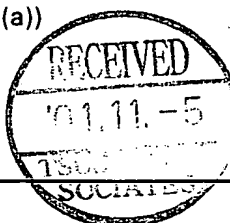
## PATENT COOPERATION TREATY

PCT

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NOTIFICATION OF RECEIPT OF  
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(PCT Rule 24.2(a))



To:

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JAPON

|  |   |
|--|---|
| Date of mailing (day/month/year)<br>14 September 2001 (14.09.01) | IMPORTANT NOTIFICATION                          |
| Applicant's or agent's file reference<br>FP2433PCT               | International application No.<br>PCT/JP01/06421 |

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

AOYAMA SEISAKUSHO CO., LTD. et al (for all designated States except US)  
OZAWA, Junzo et al (for US)

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National : CN, JP, US

## ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- ☒ time limits for entry into the national phase  
☒ confirmation of precautionary designations  
☐ requirements regarding priority documents

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

|  |   |
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For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: **FASTENER**

(57) **Abstract:** The invention relates to a fastener for members (M1, M2) to be clamped with a certain spacing therebetween, the fastener comprising a nut (10); a bolt (40); and a movable collar (20) having in an inner bore thereof a torque transmitting means capable of transmitting torque of a bolt, which is inserted axially into the inner bore, to the movable collar through thread-thread engagement, and wherein a portion of the thread of the bolt comprises special thread ridges (422), by which a frictional force greater than that obtained in engagement between normal threads is imparted to the thread-thread engagement.

WO 02/10595 A2



## DESCRIPTION

## FASTENER

## 5 TECHNICAL FIELD

The invention relates to a fastener capable of clamping members, which are to be clamped and are spaced a certain spacing from each other, while maintaining a clearance  
10 therebetween and absorbing some possible scatter in the spacing or some possible axial deviation.

## BACKGROUND OF THE INVENTION

15 United States Patent No. 5,288,191 for Edvald Rucker et al discloses a conventional fastener of the same kind as described above, which fastener involves a high manufacturing cost since it is composed of many constituent elements and a part of the elements is special in shape. Further, since  
20 forces required for movements of the constituent elements for holding of a predetermined spacing rely on a pushing force of and torque of a bolt-like member inserted into the constituent elements under frictions, an operator for performing clamping of the fastener is required to rotate the  
25 bolt-like member while applying a pushing force, so that handling of the fastener is complicated. In addition, since the fastener has no positive loosening preventive function, application of the fastener has been difficult under circumstances under much vibrations.

30

## DISCLOSURE OF THE INVENTION

The invention has been devised in order to solve the

above-mentioned problem of prior fasteners, and this problem can be solved by a fastener for members (M1, M2) to be clamped with a certain spacing therebetween, the fastener comprising a nut (10) having one end surface of a

5 substantially cylindrical-shaped main body adapted to be latched by one (M1) of the members to be clamped, the nut being formed on an inner peripheral surface thereof with a first thread (13) comprising an internal thread capable of

10 threading onto a thread of a bolt (40) and a second thread (14) comprising an internal thread inverse to thread ridges of the thread of the bolt and capable of threading onto a first thread (21) of a movable collar (20) comprising an external thread, which is formed on an outer peripheral surface of a

15 substantially cylindrical-shaped main body of the movable collar (20) and is inverse to thread ridges of the thread of the bolt; the movable collar (20) having in an inner bore thereof a torque transmitting means capable of transmitting torque of the bolt, which is inserted axially into the inner bore, to the movable collar through thread-thread engagement;

20 and the bolt (40) having a shank (42), on an outer peripheral surface of which is formed a thread comprising an external thread capable of threading into the first thread (13) of the nut; and wherein a portion of the thread of the bolt comprises special thread ridges (422), by which a frictional

25 force greater than that obtained in engagement between normal threads is imparted to the thread-thread engagement.

#### BRIEF DESCRIPTION OF THE DRAWINGS

30 Fig. 1 is a partial, cross sectional view showing a first embodiment of the invention.

Fig. 2 is a partial, cross sectional view showing a second embodiment of the invention.



Fig. 3 is a partial, enlarged cross sectional view showing an embodiment of special thread ridge portion (portion denoted by X in Figs. 1 and 2) of a bolt as a constituent element of the invention.

5 Fig. 4 is an enlarged cross sectional view showing a further embodiment of special thread ridge portion of a bolt as a constituent element of the invention.

Fig. 5 is a partial, enlarged cross sectional view showing in a stepwise manner clamping actions of the first  
10 embodiment of the invention.

Fig. 6 is a partial, enlarged cross sectional view showing in a stepwise manner clamping actions of the second embodiment of the invention.

#### 15 BEST MODE FOR CARRYING OUT THE INVENTION

The invention will be described below in detail with reference to the drawings.

20 The invention is essentially composed of a nut 10 having on one end surface of a substantially cylindrical-shaped body thereof a flange 11, of which rotation about an axis is restricted by one (first member) (M1) of members to be clamped, and formed on its inner peripheral surface with a  
25 first thread (13) (an internal thread formed on a central opening of the flange and being a right-hand thread) and a second thread (14) (an internal thread and a left-hand thread, and formed on a side where a bolt described later is inserted); a movable collar (20) having an external thread (a  
30 left-hand thread. A portion formed with the external thread is referred below to as a first thread (21)) capable of threading into the second thread (14) of the nut and formed on an outer peripheral surface of the substantially

cylindrical-shaped body; and a bolt (40) (Here, the shape of its head (41) is differently depicted between in Fig. 1 and in Fig. 2 and between in Fig. 5 and in Fig. 6 but mutually adoptable configurations are merely depicted distinctively in the separate drawings.) having external threads (421, 422) (both being a right-hand thread. Hereinbelow, "thread" is a right-hand thread unless specified. In addition, the external thread (421) is a conventional thread while the external thread (422) is a special thread. The details thereof will be described later.) capable of threading into the first thread (13) of the nut and formed on an outer peripheral surface of its shank (42). In addition, the first thread (13) of the nut may be replaced by a conventional one (Concretely, a cavity conformed to the external shape of the conventional nut may be formed centrally of the flange (11) to permit the conventional nut to be fitted in and secured to the cavity or a cavity enabling the shank of the bolt to pass therethrough in a non-contact manner may be provided centrally of the flange and one surface of the conventional flange may be made to abut against and fix to one surface of the conventional nut.).

The movable collar (20) is constructed further in the following manner.

First embodiment (see Fig. 1)

An internal thread (Hereinbelow, a portion formed with such internal thread is referred to as a second thread (22).) capable of threading onto the external threads (421, 422) formed on the outer peripheral surface of the bolt is formed on an inner peripheral surface of the movable collar.

In addition, the movable collar (20) is shown as having

a flange on an end surface of a body toward the bolt, which serves to provide a preferable seated condition (details of which is described later) of the movable collar on one (M2) of the members to be clamped). Of course, a configuration shown in Fig. 2 may serve in view of the purpose, for which a fastener according to the invention is intended.

Second embodiment (see Fig. 2) A portion (Hereinbelow, referred to as a torque transmitting nut latch (23)) corresponding to the second thread (22) of the movable collar defines a cavity having a cross section, which is similar to a torque transmitting nut (30) and capable of containing the torque transmitting nut so as to make an outer peripheral surface (Its cross section is polygonal, usually hexagonal) of the nut (30) abut against an inner surface of the cavity to an extent that rotation of the nut (30) can be substantially restricted. Here, a side of the torque transmitting nut latch toward the nut (10) is made a seat structure, on which the torque transmitting nut can be seated, while a side of the torque transmitting nut latch toward the bolt (40) is provided with a nut falling-off preventing pawl (24) to prevent falling-off of the torque transmitting nut (This nut falling-off preventing pawl (24) may be formed by applying "caulking" on at least a portion of an inner peripheral side end surface of the movable collar toward the nut (10) after the torque transmitting nut is received in the torque transmitting nut latch).

In addition, in this embodiment, the external threads (421, 422) formed on the outer peripheral surface of the bolt are formed to be capable of a thread (31) (internal thread) of the torque transmitting nut.

Further, while being commonly characteristic of the both embodiments, the external threads formed on the outer peripheral surface of the bolt are composed of a portion (421) (Hereinbelow, referred to as a first thread or a common thread ridge) having a flank angle of a common thread ridge (beta) (generally, 60 degrees) and a portion (422) (Hereinbelow, referred to as a second thread or a special thread ridge) having a special thread ridge shape or a thread configuration).

An example (Hereinbelow, referred to as a first embodiment of the special thread ridge) of such special thread ridge is shown in Fig. 3, and is concretely formed by subjecting a common thread ridge to compressive deformation in a diametrical direction. A flank angle (alpha) of the portions is naturally smaller (usually around 40 degrees) than the flank angle (beta) of a common thread ridge. Here, a range where the portions are formed suffices to be around 2 to 10 in terms of the number of thread ridges and around 10 to 90 degrees in terms of an angle about an axis. Also, the portions are at least two in number about the axis, of which a spacing is equal. However, the both portions (421, 422) have the same pitch P.

Another embodiment (Hereinbelow, referred to as a second embodiment of the special thread ridge) of the special thread ridges (422) is shown in Fig. 4. In this embodiment, a pitch (P2) or (P3) of a part of the thread ridge is greater or less than that P1 of the common thread ridge ( $P2 > P1 > P3$ ). An extension of and a range of such modification are around  $\pm 20\%$  of P1 in terms of pitch and at least one thread ridge in + (plus) and - (minus) directions, respectively.

In addition, while being commonly characteristic of the both embodiments, it goes without saying that both the first and second embodiments of the special thread ridge are applicable not to the bolt (40) but to the second thread (22) of the movable collar (20) or the thread ridge of the torque transmitting nut (30).

As further embodiments of the special thread ridges (422), there are given a thin layer (it is preferable that once having been formed, it will not fall off from a location of formation as long as it is intentionally peeled off, and it will not be bonded to a member or members, to which the thin layer abuts against) of a resin (typified by "Nylok" (trade mark) of Nylok Ltd., in the United States. While being natural, the thin layer may be formed on the second thread (22) of the movable collar (20) or threads of the torque transmitting nut (30) instead of being formed on the side of the bolt (40). Of course, formation of the thin layer (the case of being applied to the threads of the bolt (40) and the case of being applied to the side of the movable collar) may be performed in combination of adoption of the embodiments, in which the above-mentioned threads may be made special in shape or the pitch is changed. Hereinbelow, referred to as a third embodiment of the special thread ridge. In addition, formation of the thin layer may be performed in accordance with a conventional method, for example, methods described in, for example, United States Patent Application Nos. 371,604/1964; 398,495/1964; 599,042/1966; 628,683/1967; 821,178/1969; 203,130/1971; 314,854/1972 and 400,502/1973, and United States Patent Nos. RE28,812/1976; 3,995,074/1976; 4,054,688/1977; 4,100,882/1978 and 4,120,993/1978), such as special nylon, formed only on thread ridges of a portion, of which configuration, angle and pitch are the same as those of

common thread ridges, and further formation of the special thread ridges (422) from an elastic body, for example, an elastomer resin (while being natural, instead of applying such formation to the bolt, the second thread (22) of the movable collar (20) or the torque transmitting nut (30) itself may be formed from an elastic body. Hereinbelow, referred to as a fourth embodiment of the special thread ridge. In addition, formation of the special thread ridge may be performed with the use of, for example, injection molding (including insert molding)) (not shown).

Also, while being commonly characteristic of the both embodiments, materials for constituent elements of a fastener according to the invention usually include alloys typified by carbon steel, stainless steel and light alloys, but an engineering plastic typified by polyamide and polyacetal may be applied to a part or the entire of the constituent elements as far as the manufacturing cost permits.

Next, the use of the fastener according to the invention will be explained on the basis of the first embodiment (See Fig. 5. An explanation will be given with respect to the case where the special thread ridges (422) of the bolt (40) are according to the first embodiment.).

#### 1. Approach (see ① of Fig. 5)

The nut (10) with the movable collar (20) received in an inner bore thereof (in a state, in which the first thread (21) of the movable collar is threaded into the second thread (14) of the nut (10) to a maximum extent) is inserted into an opening (OP1) of one (M1) (for example, an inner panel of an automobile) of the members to be clamped, toward the bolt

(40), and the nut is latched on the member to be clamped, so that one surface of the flange (11) of the nut comes into close contact with one surface of the member to be clamped (At least one recess capable of receiving therein a nut latch (12) may be beforehand provided in a corresponding position of the member to be clamped, and the nut latch may be fitted into and welded to the recess, or after the fitting of the nut latch, a side peripheral surface of the flange may be welded to the member to be clamped. Also, it is possible to adopt a method of melting or bonding the both surfaces depending upon a material used.). The main point is to enable forming a state, in which rotation of the nut about an axis thereof is restricted relative to one (M1) of the members to be clamped.

In addition, this step is the same as in the second embodiment (see ① of Fig. 6).

2. Until the seating of the movable collar (see ② of Fig. 5)

The second thread (422) of the bolt (40) inserted into an opening (OP2) of the other (M2) (for example, a body of an automobile) of the members to be clamped, toward the nut is threaded into the second thread (22) of the movable collar to rotate the bolt in a clockwise direction.

Here, since thread ridges of the second thread (422) of the bolt are formed such that their flank angle ( $\alpha$ ) is smaller than the flank angle ( $\beta$ ) of thread ridges (of which pitch is the same as that of thread ridges of the second thread (22) of the movable collar), frictional forces

generated upon contact of flanks of the both threads with each other are substantially greater than those generated upon contact of flanks of the second thread (14) of the nut and the first thread (21) of the movable collar (of which  
5 threads are the same in angle and pitch) with each other (This state occurs similarly even when the configuration of the special thread ridges (422) is as in the second to fourth embodiments. Stated conversely, an arrangement for producing such state is concretely illustrated in the first to fourth  
10 embodiments.). As a result, the movable collar begins to rotate together with the bolt and comes forth along an axis from the nut toward the other (M2) of the members to be clamped (the first thread (21) of the movable collar and the second thread (14) of the nut are formed with left-hand  
15 threads).

Finally, an end surface of the flange provided on an end of the movable collar toward the bolt is brought into contact with the other (M2) of the members to be clamped, so that  
20 movement (movement toward the other (M2) of the members to be clamped) of the movable collar in an axial direction is stopped.

In addition, this step (see ② of Fig. 6) in the second  
25 embodiment is different from that in the first embodiment only in that mutual contact of the flanks of the second thread (22) of the movable collar and of the second thread (422) of the bolt is replaced with mutual contact of the flanks of the thread (31) of the torque transmitting nut (30)  
30 received in the torque transmitting nut latch (23) and of the second thread (422) of the bolt and torque of the bolt is transmitted to the movable collar through the torque transmitting nut (As described above, the end surface of the



movable collar toward the bolt may be further provided with a flange as in the first embodiment. The same is said of other respects.) but is the same as in the first embodiment in axial movements of the movable collar toward the other (M2) of the members to be clamped, upon the clockwise rotation of the bolt. Here, the reason why the torque transmitting nut (30) is somewhat loosely received in the torque transmitting nut latch (23) of the movable collar in a manner to present some play in a diametrical direction (Consequently, the torque transmitting nut is allowed to rotate a part of one revolution about its axis in the torque transmitting nut latch) resides in the consideration of the ability of absorbing an angle and/or deviation of axes between a direction, in which the bolt is inserted, and the axis of the movable collar (Naturally, an operation of charging the torque transmitting nut into the torque transmitting nut latch is easy).

3. Until completion of clamping (see ③ of Fig. 5)

20

Further, the bolt (40) is rotated in a clockwise direction (Torque against frictional force forced on the second thread (422) of the bolt upon contact of the end surface of the flange provided on the movable collar toward the bolt with the other (M2) of the members to be clamped is applied to the head (41) of the bolt), and the bolt is advanced in the inner bore of the nut toward the first thread (13) of the nut.

30

Finally, the first thread (421) or the second thread (422) of the bolt is threaded into the first thread (13) of the nut, and the clamping operation is terminated by continuing rotation of the bolt until a bottom surface (a

surface on a tip end side of the bolt) of the head (41) of the bolt is brought into contact with the other (M2) of the members to be clamped, with a washer (50) therebetween.

5        In addition, this step is the same also in the second embodiment (see ③ of Fig. 6).

10        In this manner, when the fastener according to the invention is used to provide clamping with a spacing (L) (This spacing will not change in the clamping operation.) between members to be clamped, some possible scatter in the spacing can be absorbed by axial displacements of the movable collar, so that a clamping operation in a substantially wide range can be performed by appropriately setting axial lengths of a main portion of the movable collar and of a main portion  
15        of the nut.

20        While being common to the first embodiment and the second embodiment, various contrivances similar to that applied to the special thread ridges (422) of the bolt may be additionally applied to either of the second thread (14) of the nut or the first thread (21) of the movable collar within a range over which they can be threaded each other at the time of completion of clamping. At the time of completion of  
25        clamping, loosening of the movable collar will be usually prevented by axial forces generated by threading the thread of the bolt into the first thread (13) of the nut (In particular, loosening of the movable collar is more effectively prevented in the case where the thread of the  
30        bolt threaded into the first thread (13) of the nut is set to comprise the special thread ridges (422)). When the fastener according to the invention is used under a circumstance suffering repeated vibrations, for example, in the case where

a member of a certain kind must be mounted to a body of an automobile, mutual frictional contact of the flanks of the second thread (14) of the nut and the first thread (21) of the movable collar displays the effect of directly  
5 suppressing loosening of the movable collar itself. In addition, in the first embodiment, the same effect can be obtained by applying various contrivances similar to that applied to the special thread ridges (422) of the bolt, to either of the thread of the bolt or the second thread (22) of  
10 the movable collar within a range over which they can be threaded each other at the time of completion of clamping.

#### INDUSTRIAL APPLICABILITY

15 As described above, since the fastener according to the invention comprise in combination constituent elements of simple structure, manufacture thereof does not require any special work and since the clamping operation relies on rotational motion of a bolt as one constituent element, any  
20 complicated manipulation is not required of an operator. The fastener according to the invention will not forcedly shorten a spacing (L) between members to be clamped each other and can readily perform clamping while absorbing some possible scatter in the spacing.

## Claims

1. A fastener for members (M1, M2) to be clamped with a certain spacing therebetween, the fastener comprising a nut  
5 (10) having one end surface of a substantially cylindrical-shaped main body adapted to be latched by one (M1) of the members to be clamped, the nut being formed on an inner peripheral surface thereof with a first thread (13) comprising an internal thread capable of threading onto a  
10 thread of a bolt (40) and a second thread (14) comprising an internal thread inverse to thread ridges of the thread of the bolt and capable of threading onto a first thread (21) of a movable collar (20) comprising an external thread, which is formed on an outer peripheral surface of a substantially  
15 cylindrical-shaped main body of the movable collar (20) and is inverse to thread ridges of the thread of the bolt; the movable collar (20) having in an inner bore thereof a torque transmitting means capable of transmitting torque of the bolt, which is inserted axially into the inner bore, to the movable  
20 collar through thread-thread engagement; and the bolt (40) having a shank (42), on an outer peripheral surface of which is formed a thread comprising an external thread capable of threading into the first thread (13) of the nut; and wherein a portion of the thread of the bolt comprises special thread  
25 ridges (422), by which a frictional force greater than that obtained in engagement between normal threads is imparted to the thread-thread engagement.

2. The fastener according to claim 1, wherein the  
30 torque transmitting means is a second thread (22) comprising an internal thread formed on an inner peripheral surface of the movable collar (20) and capable of threading onto the thread of the bolt (40).

3. The fastener according to claim 1, wherein the torque transmitting means comprises a torque transmitting nut (30) with an outer peripheral surface thereof abuttingly received in the inner bore of the movable collar (20) to such an extent that rotation thereof about an axis thereof is substantially restricted, and a torque transmitting nut latch (23) comprising a cavity, a cross section of which is similar to the torque transmitting nut.

4. The fastener according to claim 2 or 3, wherein the special thread ridges (422) comprise thread ridges obtained by subjecting common thread ridges to compressive deformation in a diametrical direction.

5. The fastener according to claim 4, wherein a region where the special thread ridges (422) are formed is around 2 to 10 in terms of the number of thread ridges and around 10 to 90 degrees in terms of an angle about an axis.

6. The fastener according to claim 2 or 3, wherein the special thread ridges (422) have a greater pitch (P2) than a pitch (P1) of a common thread ridge or a less pitch (P3) than the pitch (P1) of the common thread ridge.

7. The fastener according to claim 6, wherein a region where the special thread ridges (422) are formed has a pitch (P2) or (P3) of around  $\pm 20\%$  of (P1) and at least one thread ridge in + and - directions, respectively.

8. The fastener according to claim 2 or 3, wherein the special thread ridges (422) comprise a thin layer of a special nylon resin formed on a common thread ridge (421).

9. The fastener according to claim 2 or 3, wherein the special thread ridges (422) comprise a common thread ridge formed of an elastic body.

5

10. The fastener according to claim 9, wherein the elastic body is formed of an elastomer resin.

11. The fastener according to claim 2 or 3, wherein the special thread ridges (422) are not provided and a part of thread ridges of a second thread (22) of the movable collar (20) or of a thread (31) of a torque transmitting nut (30) comprises thread ridges obtained by subjecting common thread ridges to compressive deformation in a diametrical direction.

15

12. The fastener according to claim 11, wherein a region where the thread ridges obtained by subjecting the common thread ridges to compressive deformation in the diametrical direction are formed is around 2 to 10 in terms of the number of thread ridges and has around 10 to 90 degrees in terms of an angle about an axis.

20

13. The fastener according to claim 2 or 3, wherein the special thread ridges (422) are not provided and a part of thread ridges of a second thread (22) of the movable collar (20) or of a thread (31) of a torque transmitting nut (30) has a greater pitch (P2) than a pitch (P1) of a common thread ridge or a less pitch (P3) than the pitch (P1) of the common thread ridge.

25

30

14. The fastener according to claim 13, wherein a region where the thread ridges having a greater pitch (P2) than a pitch (P1) of the common thread ridges or a less pitch

(P3) than the pitch (P1) of the common thread ridges are formed has a pitch (P2) or (P3) of around  $\pm 20\%$  of (P1) and at least one thread ridge in + and - directions, respectively.

5        15. The fastener according to claim 2 or 3, wherein the special thread ridges (422) are not provided and thread ridges of a second thread (22) of the movable collar (20) or of a thread (31) of a torque transmitting nut (30) is formed thereon with a thin layer of a special nylon resin.

10

16. The fastener according to claim 2 or 3, wherein the special thread ridges (422) are not provided and a part of thread ridges of a second thread (22) of the movable collar (20) or of a thread (31) of a torque transmitting nut (30) comprises common thread ridges formed of an elastic body.

15

17. The fastener according to claim 16, wherein the elastic body is formed of an elastomer resin.

20        18. The fastener according to claim 2 or 3, wherein the special thread ridges (422) of the bolt (40) comprise thread ridges obtained by subjecting common thread ridges to compressive deformation in a diametrical direction, and said special thread ridges are additionally formed in either of  
25 the second thread (14) of the nut or the first thread (21) of the movable collar within a range over which they can be threaded each other at the time of completion of clamping.

19. The fastener according to claim 18, wherein a  
30 region where the special thread ridges (422) are formed is around 2 to 10 in terms of the number of thread ridges and around 10 to 90 degrees in terms of an angle about an axis.

20. The fastener according to claim 2 or 3, wherein the special thread ridges (422) of the bolt (40) have a greater pitch (P2) than a pitch (P1) of a common thread ridge or a less pitch (P3) than the pitch (P1) of the common thread ridge, and said special thread ridges are additionally formed in either of the second thread (14) of the nut or the first thread (21) of the movable collar within a range over which they can be threaded each other at the time of completion of clamping.

21. The fastener according to claim 20, wherein a region where the special thread ridges (422) of the bolt (40) are formed has a pitch (P2) or (P3) of around  $\pm 20\%$  of (P1) and at least one thread ridge in + and - directions, respectively.

22. The fastener according to claim 2 or 3, wherein the special thread ridges (422) comprise a thin layer of a special nylon resin formed on a common thread ridge (421), and said special thread ridges are additionally formed in either of the second thread (14) of the nut or the first thread (21) of the movable collar within a range over which they can be threaded each other at the time of completion of clamping.

23. The fastener according to claim 2 or 3, wherein the special thread ridges (422) comprise a common thread ridge formed of an elastic body, and said special thread ridges are additionally formed in either of the second thread (14) of the nut or the first thread (21) of the movable collar within a range over which they can be threaded each other at the time of completion of clamping.



24. The fastener according to claim 23, wherein the elastic body is formed of an elastomer resin.

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Fig.1

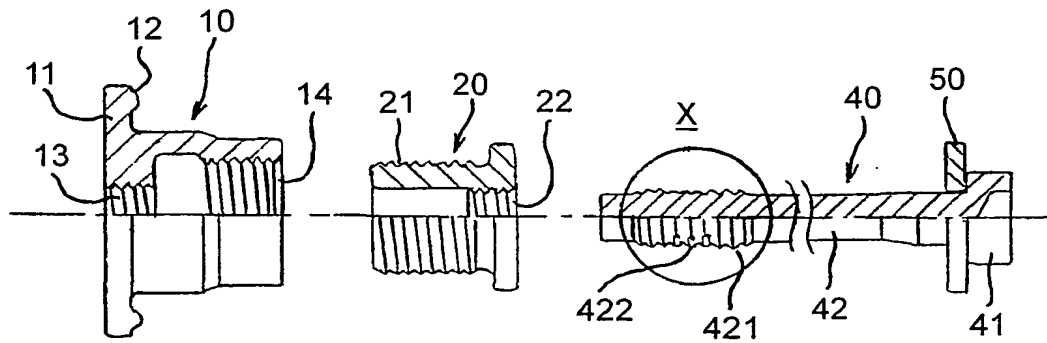
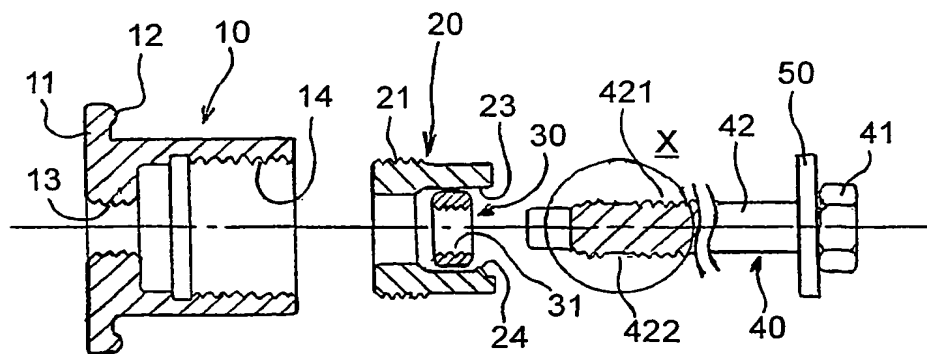


Fig.2



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Fig.3

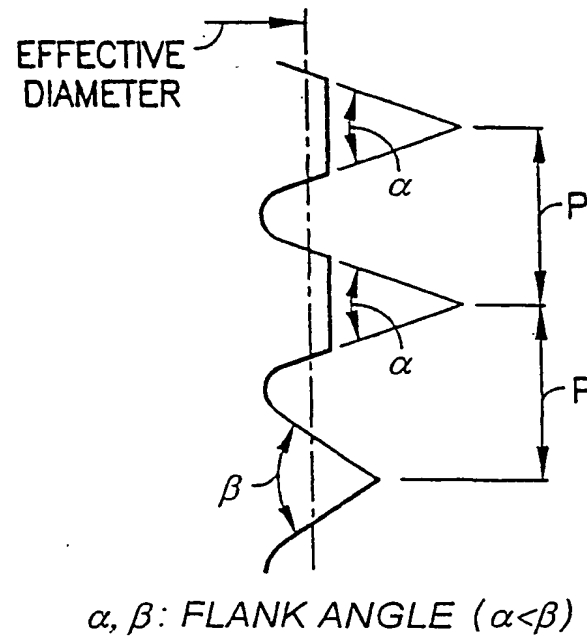
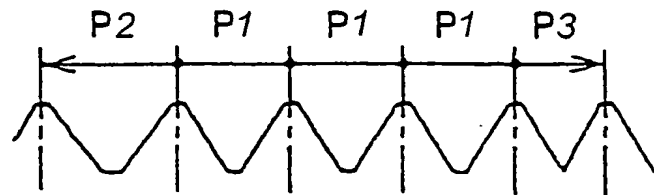


Fig.4

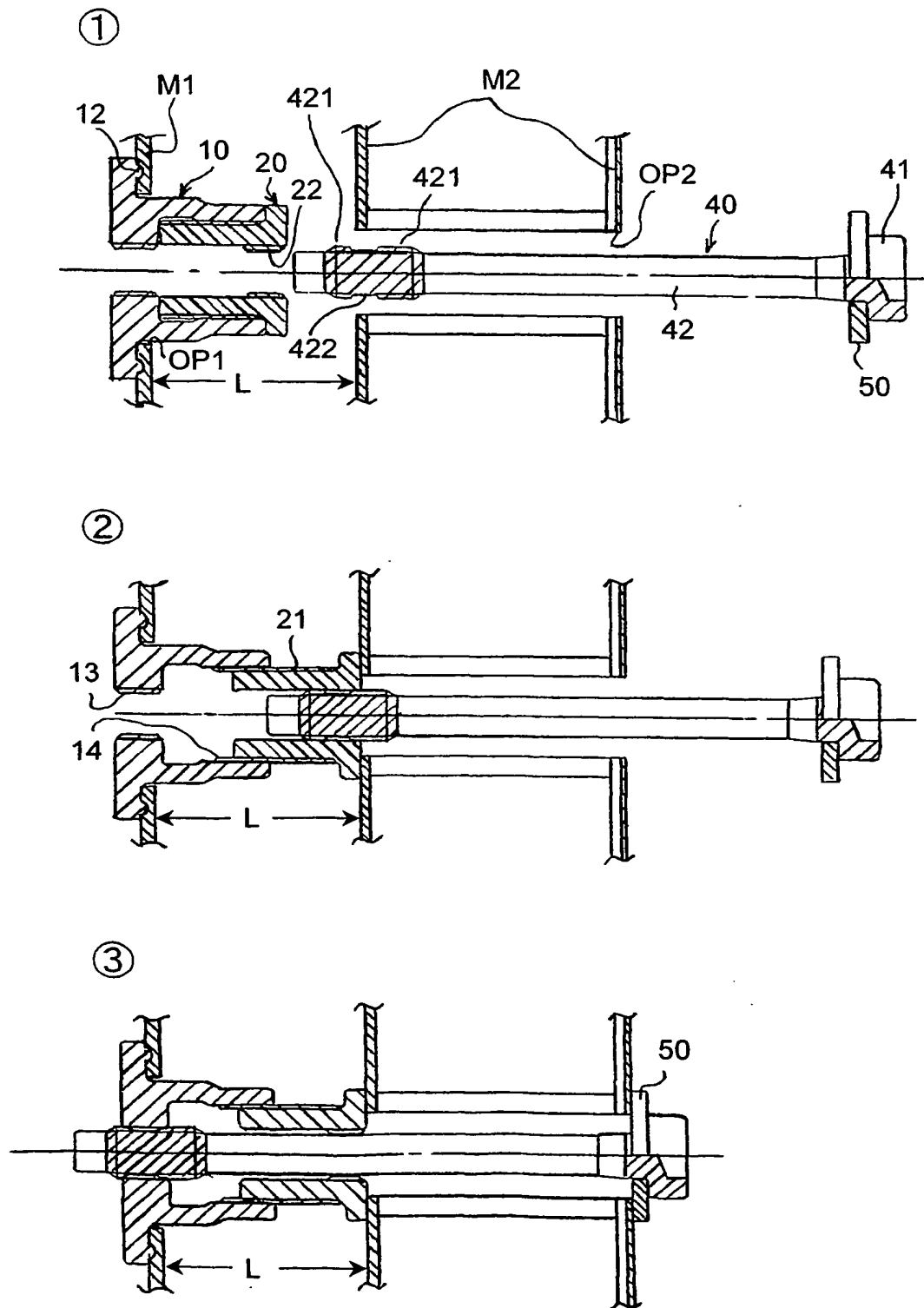


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Fig.5

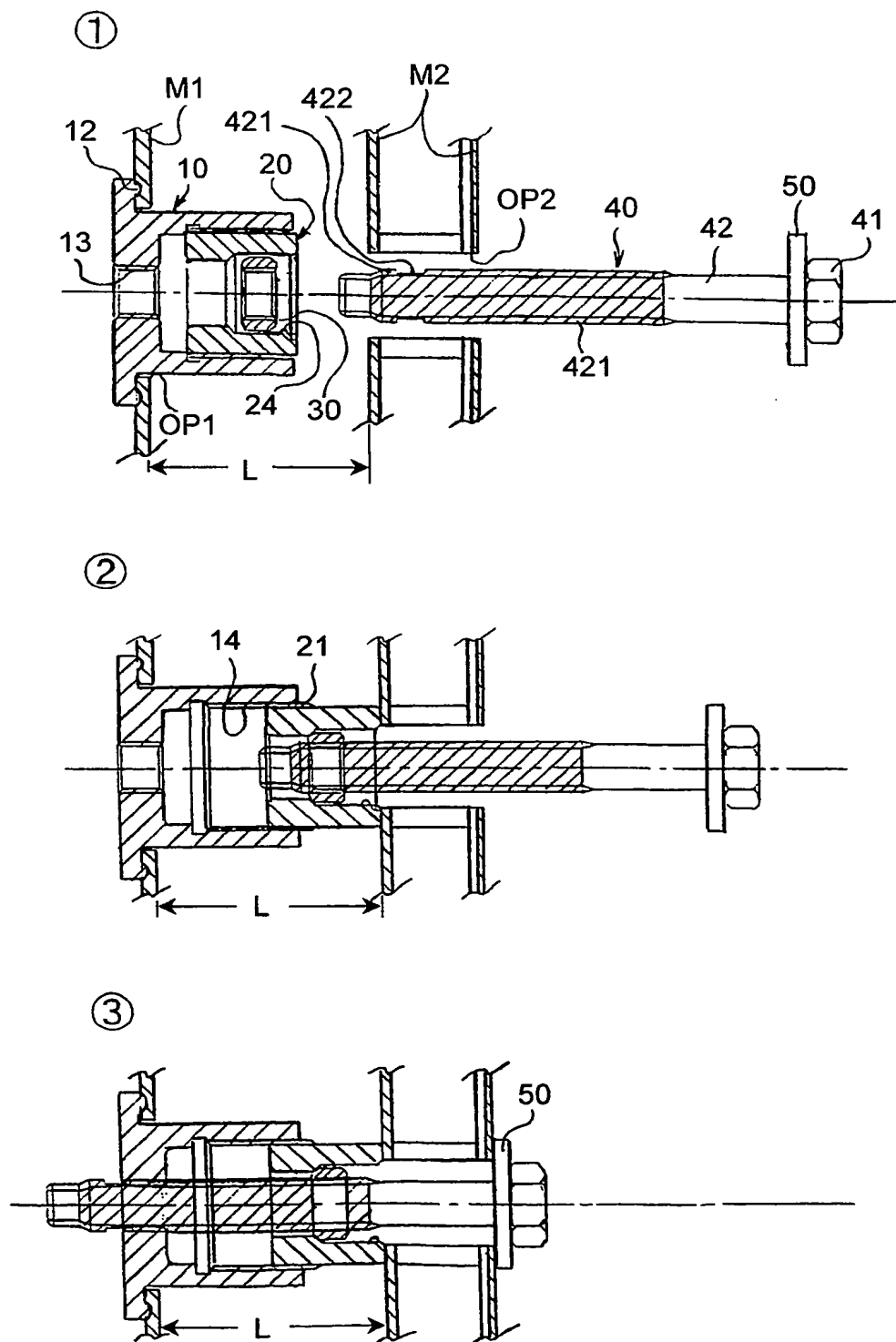


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Fig.6



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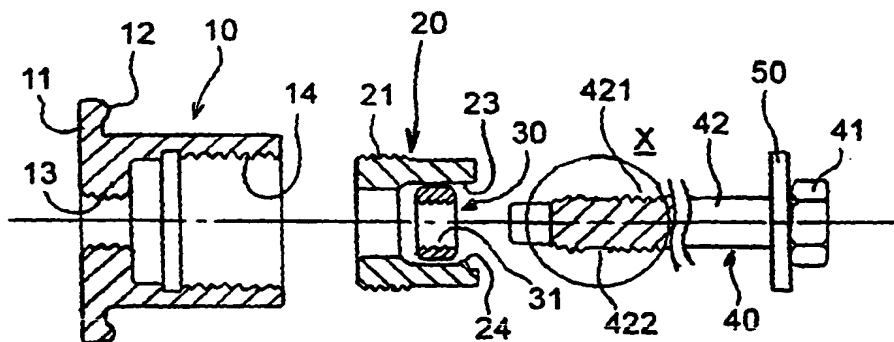
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(54) Title: **FASTENER**



(57) Abstract: The invention relates to a fastener for members (M1, M2) to be clamped with a certain spacing therebetween, the fastener comprising a nut (10); a bolt (40); and a movable collar (20) having in an inner bore thereof a torque transmitting means capable of transmitting torque of a bolt, which is inserted axially into the inner bore, to the movable collar through thread-thread engagement, and wherein a portion of the thread of the bolt comprises special thread ridges (422), by which a frictional force greater than that obtained in engagement between normal threads is imparted to the thread-thread engagement.

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## INTERNATIONAL SEARCH REPORT

Int. application No.

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## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F16B5/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

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Date of the actual completion of the international search

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International Application No

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